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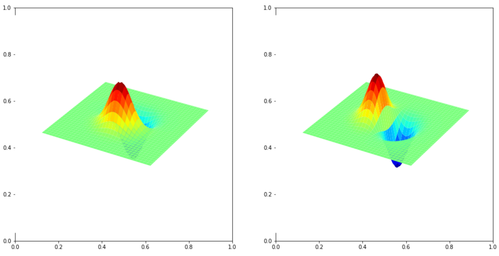
EN2550 Exercise 4 on Edges, Corners, and Blobs

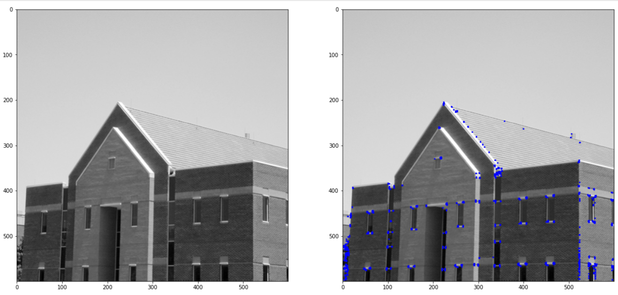
(1)

In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
import cv2 as cv
from mpl_toolkits.mplot3d  import Axes3D
from matplotlib import cm

fig, ax = plt.subplots(1, 2, figsize=(16,8))
ax1 = fig.add_subplot(121, projection="3d")
ax2 = fig.add_subplot(122, projection="3d")

delta = 0.1
xx, yy = np.meshgrid(np.arange(-5, 5 +delta, delta), np.arange(-5, 5 + delta, delta))

sigma = 1
g = np.exp(-(xx**2 + yy**2)/(2*sigma**2))
g /= np.sum(g)
sobel_v = np.array([[-1, -2, -1], [0, 0, 0], [1, 2, 1]], dtype=np.float32)
g_x = cv.filter2D(g, -1, sobel_v)
sobel_h = np.array([[-1, 0, 1], [-2, 0, 2], [-1, 0, 1]], dtype=np.float32)
g_y = cv.filter2D(g, -1, sobel_h)

surf1 = ax1.plot_surface(xx, yy, g_x, cmap=cm.jet, linewidth=0, antialiased=True)
surf2 = ax2.plot_surface(xx, yy, g_y, cmap=cm.jet, linewidth=0, antialiased=True)
ax1.axis("off")
ax2.axis("off")
plt.show()
```



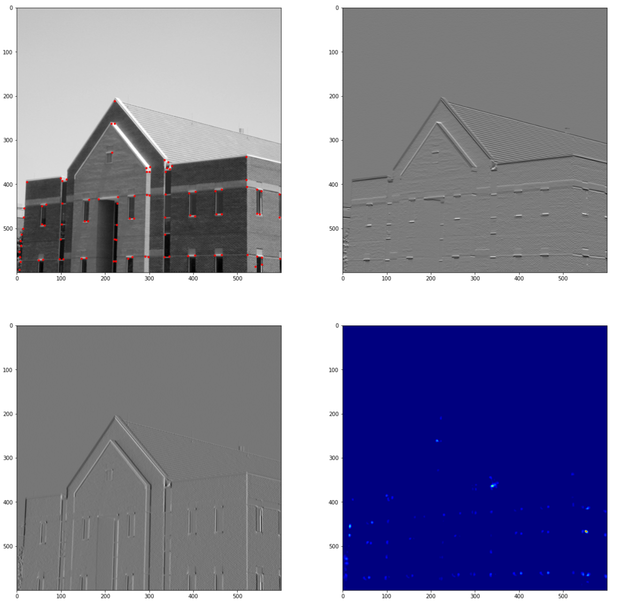
(2)

In [2]:
```
img = cv.imread(r"Images/building.tif", cv.IMREAD_COLOR)
assert img is not None

imgs = img.copy()
gray = cv.cvtColor(img, cv.COLOR_BGR2GRAY)
gray = np.float32(gray)
dst = cv.cornerHarris(gray, 2, 3, 0.04)
dst = cv.dilate(dst, None)
img[dst>0.01*dst.max()] = [0, 0, 255]

fig,ax = plt.subplots(1, 2, figsize = (20, 20))
ax[0].imshow(cv.cvtColor(imgs, cv.COLOR_BGR2RGB))
ax[1].imshow(img)
plt.show()
```



(3)

In [3]:
```
from skimage.feature import peak_local_max

img = cv.imread(r"Images/building.tif", cv.IMREAD_COLOR)
assert img is not None

I = cv.cvtColor(img, cv.COLOR_BGR2GRAY)
I = np.float32(I)
sobel_v = np.array([[-1, -2, -1], [0, 0, 0], [1, 2, 1]], dtype=np.float32)
sobel_h = np.array([[-1, 0, 1], [-2, 0, 2], [-1, 0, 1]], dtype=np.float32)

Ix = cv.filter2D(I, -1, sobel_v)
Iy = cv.filter2D(I, -1, sobel_h)

sigma = 3
ksize = 7
m11 = cv.GaussianBlur(Ix*Ix, (ksize, ksize), sigma)
m12 = cv.GaussianBlur(Ix*Iy, (ksize, ksize), sigma)
m21 = m12
m22 = cv.GaussianBlur(Iy*Iy, (ksize, ksize), sigma)

det = m11*m22 - m12*m21
trace = m11 + m22
alpha = 0.04
R = det - alpha*trace**2
R[R < 1e8] = 0
coordinates = peak_local_max(R, min_distance=2)

fig, ax = plt.subplots(2, 2, figsize=(20, 20))
ax[0, 0].imshow(img, cmap="gray")
ax[0, 0].plot(coordinates[:, 1], coordinates[:, 0], "r.")
ax[0, 1].imshow(Ix + 127, cmap="gray")
ax[1, 0].imshow(Iy + 127, cmap="gray")
ax[1, 1].imshow(R + 127, cmap=cm.jet)
plt.show()
```



(4)

In [4]:
```
img = cv.imread(r"Images/building.tif", cv.IMREAD_GRAYSCALE)
assert img is not None

edges = cv.Canny(img, 100, 200)
fig,ax = plt.subplots(1, 2, figsize = (20, 20))
ax[0].imshow(img, cmap="gray")
ax[1].imshow(edges, cmap="gray")
plt.show()
```